

## CLAIMS:

## 1. Display apparatus (1) comprising:

- an electrophoretic medium (5) comprising charged particles (6) in a fluid;
- a plurality of picture elements (2);
- a first and second electrode (3, 4) associated with each picture element (2) for receiving a potential difference, said charged particles being able to occupy a position being one of at least four positions, two of said positions being extreme positions substantially adjacent said electrodes and the remaining positions being intermediate positions between said electrodes (3, 4); and
- drive means arranged to supply a sequence of picture potential differences to each of said picture elements (2) so as to cause said charged particles (6) to occupy one of said positions for displaying an image; wherein said sequence of picture potential differences form a driving waveform for a) causing said charged particles (6) to move cyclically between said extreme positions in a single optical path and effect a desired optical transition along said optical path, if the desired optical transition is from a first intermediate position to a second intermediate position or between an intermediate position and the extreme position furthest therefrom, and b) if the desired optical transition is from an intermediate position to the extreme position closest thereto, causing said charged particles to move substantially directly towards the extreme position via the shortest route and effect said optical transition.

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2. Display apparatus (1) according to claim 1, wherein an optical transition from a first intermediate position to an extreme position closest thereto is effected substantially directly by means of a single voltage pulse (20).

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3. Display apparatus (1) according to claim 1 or claim 2, wherein said single voltage pulse (20) is of substantially equal amplitude and duration, and of opposite polarity, to the picture potential difference required to effect an optical transition from said extreme position to said intermediate position.

4. Display apparatus (1) according to any one of the preceding claims, wherein said driving waveform comprises pulse width modulated voltage pulses.

5. Display apparatus (1) according to any one of claims 1 to 3, wherein said driving waveform comprises voltage modulated voltage pulses.

6. Display apparatus (1) according to any one of the preceding claims, wherein the drive waveforms are preceded by single shaking pulse.

10 7. Display apparatus (1) according to any one of the preceding claims, wherein the drive waveforms are preceded by more than one shaking pulse

8. Display apparatus (1) according to claim 6 wherein the polarity of the single shaking pulse is opposite to that of the first pulse of the subsequent drive waveform.

15 9. Display apparatus (1) according to any one of claims 6 to 8, wherein the energy value (defined as the integration of voltage pulse with time) of a shaking pulse is sufficient to release the particles (6) at one of the extreme positions but insufficient to move the particles (6) from one of the extreme positions to the other.

20 10. Display apparatus (1) according to any one of the preceding claims, wherein said driving waveform is substantially dc-balanced.

11. A method of driving a display apparatus (1) comprising:

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- an electrophoretic medium (5) comprising charged particles (6) in a fluid;
- a plurality of picture elements (2);
- a first and second electrode (3, 4) associated with each picture element (2) for receiving a potential difference, said charged particles (6) being able to occupy a position being one of at least four positions, two of said positions being extreme

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- positions substantially adjacent said electrodes (3, 4) and the remaining positions being intermediate positions between said electrodes (3, 4); and
- drive means arranged to supply a sequence of picture potential differences to each of said picture elements (2) so as to cause said charged particles (6) to occupy one of said positions for displaying an image, wherein said sequence of picture potential

5 differences form a driving waveform; the method comprising causing said charged particles (6) to move cyclically between said extreme positions in a single optical path and effect a desired optical transition along said optical path, if the desired optical transition is from a first intermediate position to a second intermediate position or between an intermediate position and the extreme position furthest therefrom, and, if the desired optical transition is from an intermediate position to the extreme position closest thereto, causing said charged particles (6) to move substantially directly towards the extreme position via the shortest route and effect said optical transition.

10 12. Drive means for driving a display apparatus (1) according to any one of claims 1 to 10, said drive means being arranged to supply a sequence of picture potential differences to each of said picture elements (2) so as to cause said charged particles (6) to occupy one of said positions for displaying an image; wherein said sequence of picture potential differences form a driving waveform for a) causing said charged particles (6) to move cyclically between 15 said extreme positions in a single optical path and effect a desired optical transition along said optical path, if the desired optical transition is from a first intermediate position to a second intermediate position or between an intermediate position and the extreme position furthest therefrom, and b) if the desired optical transition is from an intermediate position to the extreme position closest thereto, causing said charged particles (6) to move substantially 20 directly towards the extreme position via the shortest route and effect said optical transition.